May 1966

U.S. FOREST SERVICE
RESEARCH NOTE RM - 61

FOREST SERVICE
U.S. DEPARTMENT OF AGRICULTURE
ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

Accuracy of Soil Moisture Readings with Unsealed Access Tubes

Arnett C. Mace, Jr.[1]

Soil moisture measurements by the neutron-scattering technique are often made at depths above the zone of saturation, or water table, while other measurements must be taken where the water table is encountered. Sealing the bottoms of all access tubes during installation has been an accepted practice to prevent water from entering the tube, and thereby permitting readings from below the water table. It would be advantageous in some studies to utilize an access tube for both soil moisture and water table depths, provided condensation inside the tube does not significantly affect soil moisture readings, where loss of readings from the zone of saturation can be tolerated. The objectives of this study were to determine whether accurate soil moisture measurements could be made if access tubes were not sealed on the bottom, and also utilized as a water table well where desired.

Methods

Soil moisture was measured by the neutron-scattering technique during November, December, March, and April on four plots located in a north-facing grassland, a south-facing grassland, a mixed conifer and an aspen type on the Apache National Forest, Arizona. Slope gradient was low, ranging between 2 and 6 percent. Two aluminum access tubes, 2.000 inches, outside diameter (OD) and 1.900 inches inside diameter (ID), were placed 2.5 feet apart to a depth of 9.5 feet in each of eight plots, and 6.0 feet in the remaining eight plots. A portable drill used with air to flush out the soil left a hole of approximately 2.25 inches. One access tube in each plot was sealed with plastic roofing compound, No. 10-1/2 rubber stopper, and plastic electrical tape to prevent water from entering the tube. The other access tube was left unsealed and placed in the hole. The unsealed tubes were located downslope from the sealed tubes. Each tube was then backfilled with sand, tamped tightly, and capped with a rubber stopper and small tin can to prevent entry of moisture from above.

Results

Group comparison analysis of 978 measurements taken from both sealed and unsealed access tubes at all levels of the profile indicates no significant difference between tubes. Further analysis based on paired comparison and group comparison of data summarized by plots and depths indicated no significant difference at the 1 or 5 percent level. Average

[1] *Research Forester, located at Tempe, in cooperation with Arizona State University; central headquarters maintained at Fort Collins in cooperation with Colorado State University. Mace is now Instructor-Research Associate, Department of Watershed Management, University of Arizona, Tucson.*

water content in 6 inches of soil for each plot and access tube from depths 0 to 5.5 feet is shown below:

	Sealed	Unsealed	Deviation
		(inches of water)	
Plot No:			
1	2.08	1.92	- 0.16
2	1.99	2.08	.09
3	2.55	2.36	-.19
4	2.23	2.34	.11
5	2.22	2.46	.24
6	2.46	2.57	.11
7	2.46	2.85	.39
8	1.86	2.03	.17
9	2.14	2.17	.03
10	2.06	2.17	.11
11	2.30	2.15	-.15
12	2.18	2.12	-.06
13	2.29	2.21	-.08
14	1.99	1.90	-.09
15	2.19	1.91	-.28
16	2.13	2.28	.15
Total	35.13	35.52	.39
Mean	2.20	2.22	.02

The means of water content measured by the sealed and unsealed tubes are remarkably similar. Deviations between water content measurements on the individual plots may be due to lateral movement of water, especially under saturated conditions.

These results indicate it is not necessary to seal access tubes in areas where the water table is below the depth of installation. These conditions exist throughout the Southwest in the chaparral type, and in some areas of the ponderosa pine and mixed-conifer types.

In this particular study, the measurements taken above the zone of saturation were accurate since the presence of condensation inside the unsealed access tube had a negligible influence on measurements. In studies with water tables near the surface, it would be desirable to use sealed tubes, because entry of water could prevent accurate following of moisture-depletion rates by neutron readings and, also might cause short-circuiting and corrosion of the probe.

Agriculture --- CSU, Ft. Collins